

BECKMAN

Model J2-21M

Centrifuge

Instruction Manual



Safety Reminder

The cautionary information on this page is provided to remind the operator of certain potentially hazardous conditions. Read these brief instructions before operating the instrument.

Maintenance that requires the removal of instrument panels will involve exposure to electrical and mechanical hazards and should be performed only by qualified, trained personnel. **UNPLUG THE CENTRIFUGE** before removing panels, or turn off and lock out the main wall breaker if your instrument is hard wired to the wall.

The Model J2-21M centrifuge is not designed for use with flammable liquids. Be sure power to the centrifuge is off before using ethanol or any other flammable liquid in the vicinity of the centrifuge.

Spills may generate aerosols. Hazardous materials must not be run in this centrifuge unless all necessary safety precautions are taken. The vacuum system exhausts continuously through filters that cannot be relied upon for complete trapping of airborne particles. The filter bottles that retain these particles do not require maintenance.

Labels shown here are attached to the Model J2-21M. Replacement labels will be provided free of charge by writing to Beckman Instruments, Marketing Department, P. O. Box 10500, Palo Alto, CA 94304.

CAUTION
TO REPLACE DRIVE BELT, SEE SERVICE MANUAL.
DO NOT LOOSEN MOUNTING BOLTS.

ATTENTION!
POUR REMPLACER LA COURROIE DE TRANSMISSION,
CONSULTEZ LE MANUEL D'ENTRETIEN.
NE PAS DESERRER LES BOULONS DE MONTAGE.

VORSICHT
ZUM AUSTAUSCH DES TREIBRIEMENS
BEDIENUNGSANLEITUNG BEACHTEN.
BOLZEN AM MOTOR NICHT LÖSEN.

PRECAUCIÓN
PARA REEMPLAZAR LA CORREA DE TRANSMISIÓN,
CONSULTE EL MANUAL DE SERVICIO.
NO AFLOJE LOS TORNILLOS DE MONTAJE.

270-340617-1

DANGER!
HIGH VOLTAGE

DANGER!
HAUTE TENSION

ACHTUNG!
HOCHSPANNUNG

¡PELIGRO!
ALTA TENSION

270-340734

CAUTION **VORSICHT!**
ROTATING MACHINERY **VOR ARBEITEN AM MOTOR**
DISCONNECT POWER AND ALLOW STROM ABSCHALTEN UND VOLLKOMMENEN STILLSTAND ABWARTEN
UNIT TO STOP BEFORE SERVICING

ATTENTION! **¡PRECAUCIÓN!**
APPAREIL ROTATIF **SISTEMA GIRATORIO**
COUPER LE COURANT ET DESCONECTE LA ENERGIA
ATTENDRE L'ARRET COMPLET DE LA ELECTRICIDAD Y PERMITA QUE LA
L'APPAREIL AVANT TOUTE INTERVENTION MAQUINA SE PARE ANTES DE MANIPULARLA
270-340801-B Printed in U.S.A.

CAUTION

1. READ MANUAL BEFORE SERVICING.
2. DISCONNECT POWER BEFORE UNDERTAKING REPAIR OR MAINTENANCE.
3. ELECTRICAL OR REFRIGERATION SERVICING TO BE PERFORMED BY QUALIFIED PERSONNEL ONLY.
4. REPLACE ALL ACCESS COVERS BEFORE OPERATING MACHINE.
5. USE BECKMAN-APPROVED PARTS ONLY.

ATTENTION!

1. LIRE LE MANUEL D'INSTRUCTIONS AVANT ENTRETIEN OU REPARATION.
2. COUPER LE COURANT AVANT D'ENTREPRENDRE DES REPARATIONS OU DES TRAVAUX D'ENTRETIEN.
3. SEUL UN PERSONNEL QUALIFIE PEUT PROCEDER A L'ENTRETIEN OU AUX REPARATIONS DE L'APPAREILLAGE ELECTRIQUE OU DE REFRIGERATION.
4. REMETTRE EN PLACE TOUS LES PANNEAUX D'ACCES AVANT DE FAIRE FONCTIONNER LA MACHINE.
5. N'EMPLOYER QUE DES PIECES AGREEES PAR BECKMAN.

ACHTUNG!

1. VOR WARTUNGSARBEITEN GEBRAUCHSANWEISUNG LESEN.
2. VOR DURCHFÜHRUNG VON REPARATUR-ODER WARTUNGSARBEITEN NETZSTECKER ZIEHEN.
3. ELEKTRIK UND KÜHLUNG DARF NUR VON FACHPERSONAL GEWARTET WERDEN.
4. VOR ERNEUTER INBETRIEBNAHME ALLE ENTFERNTEN ABDECKUNGEN WIEDER ANBRINGEN.
5. NUR VON BECKMAN GENEHMIGTE TEILE VERWENDEN.

¡PRECAUCIÓN!

1. LEA EL MANUAL ANTES DE SERVICIO DE MANTENIMIENTO O REPARACION.
2. DESCONECTE LA ENERGIA ELECTRICA ANTES DE EMPRENDER LAS REPARACIONES O EL MANTENIMIENTO.
3. SOLO EL PERSONAL COMPETENTE DEBE EFECTUAR LOS SERVICIOS DE MANTENIMIENTO O DE REPARACION ELECTRICA O DE REFRIGERACION.
4. ANTES DE ACOLOCAR TODAS LAS COBIERTAS DE ACCESO ANTES DE OPERAR LA MAQUINA.
5. UTILICE ÚNICAMENTE PIEZAS DE REPUESTO APROBADAS POR BECKMAN.

270-340801-A

BECKMAN

Model J2-21M Centrifuge



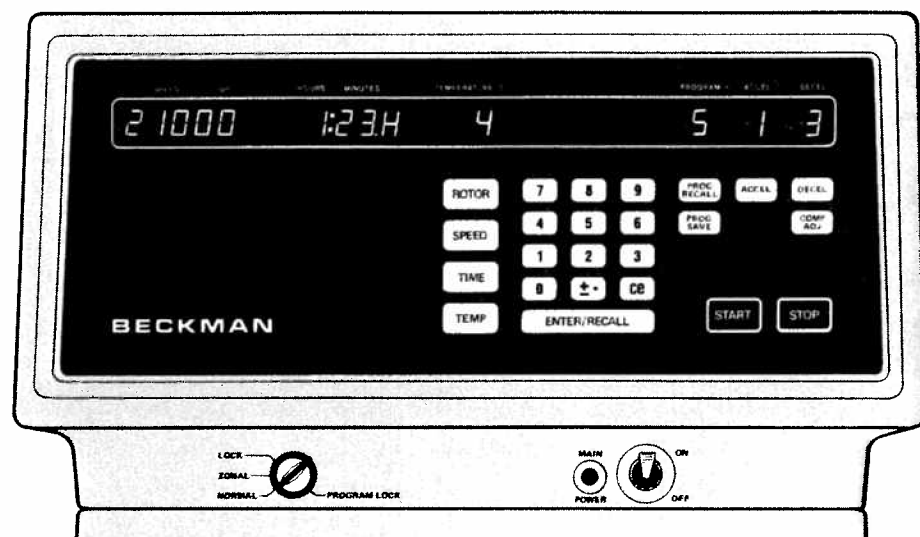
Instruction Manual

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Introduction

The Model J2-21M is a floor-model, refrigerated centrifuge for general purpose laboratory use. The Model J2-21M is microprocessor-controlled and introduces a brushless, induction motor. The instrument features: digital displays, touch switches, keyboard, 10 acceleration rates, 10 deceleration rates, 10 program memories, automatic temperature control, and automatic maximum speed limits.

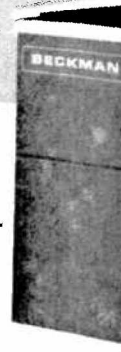
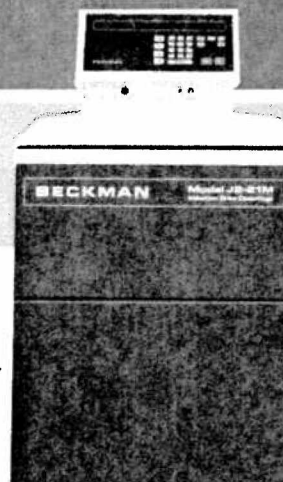
Digital displays indicate actual rotor speed, rotor temperature, run time remaining or elapsed, program number, acceleration rate, and deceleration rate. The displays also show keyboard entries.

Touch switches operate with light finger pressure. These are pressure switches, not capacitance or thermal switches. There is an audible tone "beep" when a switch is pressed and activated.

The Model J2-21M operates in the NORMAL, PROGRAM LOCK, and ZONAL modes. In NORMAL operation, use the keyboard and the parameter entry keys to select the run conditions, or press only **PROG RECALL**, the appropriate keyboard digit, and **START**. The PROGRAM LOCK mode is for repeating the same program only. The operator presses only **ENTER/RECALL** and **START**. The ZONAL mode is used for open-door operation of zonal rotors.

For sample and rotor protection, a rotor will automatically decelerate if certain abnormal conditions occur. A diagnostic message will flash on the control panel to signal the condition. Usually the operator can then correct the condition and restart the run.

Specifications



Control Characteristics

Rotor identify Used to limit speed to rotor maximum and provide automatic temperature control.

Speed

Speed range 100 to 21 000 rpm

Speed control Actual rotor speed will be within 20 rpm of the set speed.

Speed display Digital readout indicates actual rotor speed in revolutions per minute in 10-rpm increments and four significant figures.

Time

Time range 0 to 99 hours 59.9 minutes for timed runs; entries greater than 99 h 59.9 min signal "hold" or continuous operation.

Time display Digital readout indicates time remaining for timed runs, time elapsed for continuous operation.

Rotor temperature

Temperature range -20° to $+40^{\circ}\text{C}$

Temperature control $\pm 2^{\circ}$ for temperatures of 0° to ambient. Temperature control at higher or lower temperatures depends on the rotor and speed used.

Temperature display Digital readout indicates rotor temperature in degrees Celsius in 1-degree increments.

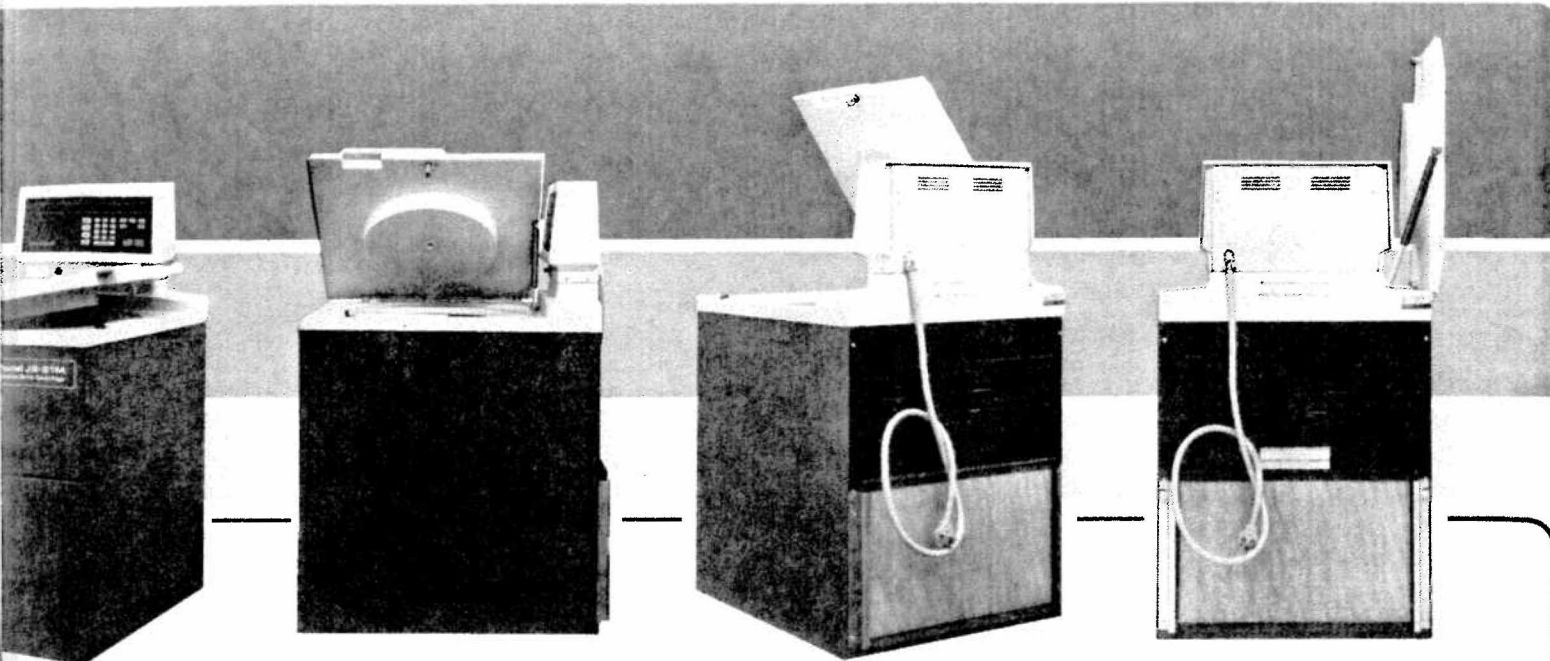
Acceleration Select from 9 acceleration rates, or maximum acceleration.

Deceleration Select from 9 deceleration rates, maximum dynamic braking, or a coasting stop from full speed.

Operating modes Key switch selects NORMAL, ZONAL, or PROGRAM LOCK operating modes.

Operational Features

Self diagnostics Interlocks prohibit drive operation in the event of a speed controller malfunction, excessive chamber temperature, an imbalanced rotor, a broken drive belt, an open chamber door, or use of the **STOP** switch during a PROGRAM LOCK run. Poor chamber vacuum and power failures are indicated.



Drive unit High-torque, variable-frequency induction motor; belt-driven rotor spindle.

Vacuum Mechanical vacuum pump reduces chamber pressure to 51 kPa (1/2 atm).

Physical Data

Weight (uncrated) 298 kg (656 lb)

Height

- to chamber door 940 mm (37 in.)
- to top of control panel 1270 mm (50 in.)
- with door open 1600 mm (63 in.)

Width 711 mm (28 in.)

Depth 838 mm (33 in.)

Minimum clearances

- both sides and rear 150 mm (6 in.)
- when using JE-6B or JCF-Z rotors 300 mm (12 in.)

Diameter of rotor chamber 360 mm (14 1/4 in.)

Power 60-Hz; 208/240 Vac nominal power
50-Hz; 220 Vac nominal power

Fusing 30-A circuit breaker (on/off)

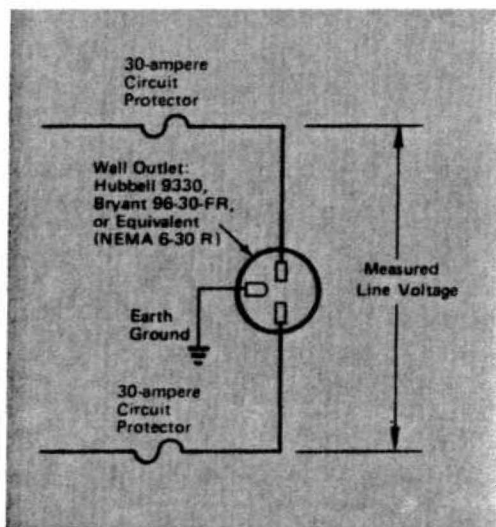
Finish Mylar* on control panel, urethane paint on door, vinyl paint on other surfaces.

Maximum heat dissipation
into the room 3.5 kW (12 000 Btu/h)

The Model J2-21M will operate within stated specifications in an ambient temperature range of 16° to 38°C.

*A registered trademark of E.I. du Pont de Nemours & Company.

Preinstallation Requirements



The Model J2-21M Centrifuge will be installed by a Beckman Field Service Representative upon initial purchase of the instrument. Pre-installation requirements for power and location are described below.

ELECTRICAL REQUIREMENTS

The voltage indicated on the name rating plate on the back of the centrifuge should agree with the measured line voltage. The Beckman Representative can rewire the centrifuge, if necessary, to adapt it to the available voltage. He also provides a new rating plate with the new voltage marked on it.

The Model J2-21M requires 208- or 240-V power, fused for 30 A. The system includes earth ground and two power leads with circuit protectors.

Range for 208-V, 60-Hz unit 187 - 223 V

Range for 240-V, 60-Hz unit 224 - 264 V

Range for 220-V, 50-Hz unit 210 - 224 V

The power cord on 50-Hz units is not equipped with a plug, so both a receptacle and a plug complying with local electrical standards must be supplied. Cords on 60-Hz units have a plug.

WEIGHT AND DIMENSIONS

Weight (uncrated)	298 kg (656 lb)
Width	711 mm (28 in.)
Depth	838 mm (33 in.)
Height	
to top of control panel	1270 mm (50 in.)
with door open	1600 mm (63 in.)
to chamber door	940 mm (37 in.)
Minimum clearances	
both sides and rear	150 mm (6 in.)
when using JE-6B or JCF-Z rotors	300 mm (12 in.)

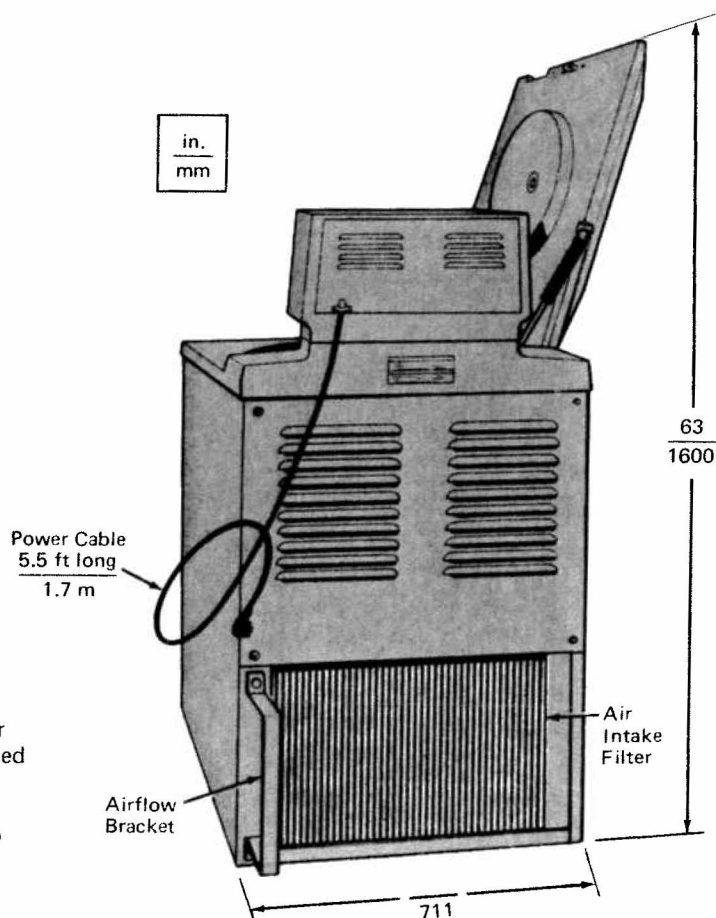
Locate the instrument in a clean, safe, uncluttered environment with good ventilation and a level floor. Surrounding temperatures during operation that exceed 38°C will cause premature component failure. Select a location away from heat-producing laboratory equipment.

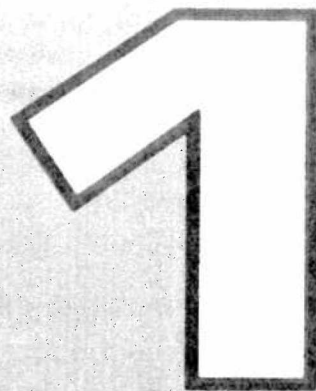
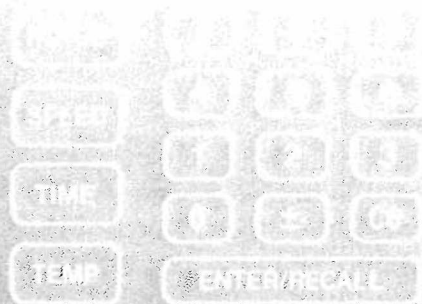
MAXIMUM HEAT DISSIPATION into the room

3.5 kW (12 000 Btu/h)

AIRFLOW FILTER AND BRACKET

An airflow bracket will be installed on the back of the centrifuge to ensure the minimum clearances required for proper air flow. A filter bracket and a disposable filter will be installed to keep the air intake area clean. Efficiency of the refrigeration system may be seriously reduced by buildup of dust on the air intake area. The filter should be replaced every one to three months as it collects dust.





Description

This section describes major instrument components. The control panel is explained in OPERATION. Unfold the illustration at the back of this manual to locate components and control panel keys.

DRIVE UNIT

The rotor drive spindle is belt-driven by the Ultra-Smooth induction motor. The variable frequency design of this motor provides high torque for fast acceleration rates. The brushless design and ball bearings greatly extend service life. Motor and spindle are attached to a rubber-mounted subplate to minimize noise and vibration.

NOTE: Some vibration occurs as a rotor accelerates between 600 and 800 rpm. This vibration, as the rotor shifts to rotate about its center of mass, is normal. Abnormal vibration will trigger the imbalance detector.

If the drive belt breaks during centrifugation, the rotor will decelerate to a stop and the diagnostic message **BELT** will flash on the control panel. The centrifuge will not restart until the diagnostic is cleared and the belt is replaced (described in MAINTENANCE).

DOOR OPERATION

The chamber door is hinged on the left and locks on the right. The door can be opened only by using the door handle and only if **POWER** is ON and the rotor is stopped (or the rotor is spinning below 3000 rpm and the key switch is in the **ZONAL** position). The door locks when **START** is pressed or **POWER** is turned OFF. The diagnostic message **DOOR** will flash on the control panel if the door is not closed for **NORMAL** and **PROGRAM LOCK** operation.

NOTE: The door cannot be opened or closed with **POWER OFF**.

Pull the door latch lever forward and lift up on the handle to open the door. Initial opening of the door is assisted by a built-in torsion bar. When the door is about three-quarters open, a gas spring takes over and opens the door the rest of the way. The door will remain open without support. In the event of a power failure, the door lock can be tripped for sample recovery (refer to MAINTENANCE).

REFRIGERATION SYSTEM

The refrigeration compressor is in the lower rear of the centrifuge. The evaporator surrounds the rotor chamber. To achieve temperature control, the compressor cycles on and off.

Because the system works only to cool the chamber, run temperatures above room temperature depend on frictional heating which is a function of the rotor and speed being used.

Filtered cooling air enters the system through the air intake area at the lower rear of the centrifuge. A bracket installed on the centrifuge ensures minimum clearances for proper air flow.

TEMPERATURE SENSING

A thermistor in the bottom of the rotor chamber continuously monitors chamber temperature. Because rotors differ in size and mass and there is windage in the chamber, *chamber temperature* and *rotor temperature* are not the same. The microprocessor calculates the required chamber temperature to achieve the selected rotor temperature by using a set of compensation values for the particular rotor being used. (The rotor is identified to the microprocessor by using the **ROTOR** parameter entry key.) During a run, the digital display indicates *rotor temperature* within 2°C.

NOTE: The **COMP ADJ** parameter entry key allows the operator to add to or subtract from the compensation values used by the microprocessor to calculate rotor temperature. The results of a dynamic temperature calibration may indicate that such an adjustment is necessary for temperature control within 1°C.

The microprocessor monitors the thermistor and verifies a temperature change as the chamber cools to the required temperature. If rotor temperature starts to increase and rises more than 4°C above the selected temperature, the diagnostic message TEMP will flash on the control panel and the rotor will decelerate to a stop. This overtemp system is not operative in the ZONAL operating mode.¹ However, if chamber temperature ever exceeds 45°C, the TEMP diagnostic will flash and the run will be aborted.

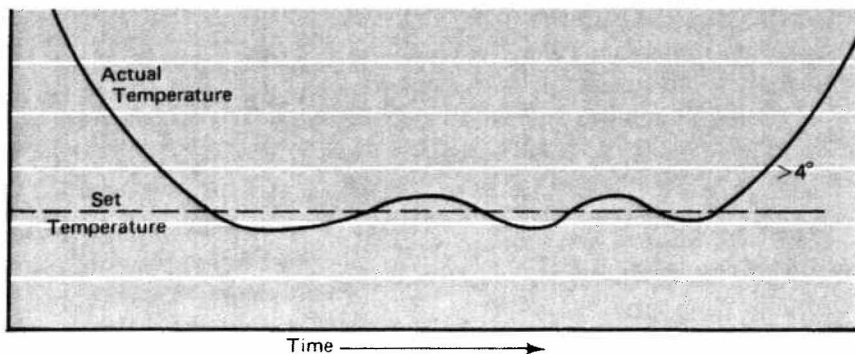


Figure 1. Temperature Sensing and Control Diagram. If the actual rotor temperature rises 4°C above set temperature, the TEMP diagnostic will flash.

¹ The ZONAL mode permits open-door operation to 3000 rpm. Placing the key switch in ZONAL overrides the overtemp diagnostic in order to avoid unnecessary run shut down during open-door centrifugation.

SPEED CONTROL SYSTEM

The speed control system is activated when **START** is pressed. Rotor speed is then controlled to within 20 rpm of the selected speed.

The **ROTOR** parameter entry key is used to identify the rotor to the microprocessor, effecting two additional controls: (1) speed selections greater than the rotor's maximum speed will not be accepted for the run speed, and (2) during the run, if the rotor exceeds its maximum speed, the diagnostic message **SPEED** will flash on the control panel and the rotor will decelerate to a stop.

In addition, rotor speed can be controlled during acceleration and/or deceleration by selecting one of nine acceleration and one of nine deceleration rates. Rotor speed is then controlled so that the rotor accelerates to 500 rpm in a selected time, and decelerates from 500 rpm in a selected time. These times are given later in Table 2.

VACUUM SYSTEM

The centrifuge uses a mechanical vacuum pump to reduce chamber pressure below 51 kPa (1/2 atm) during a run. Reduced pressure helps a rotor reach maximum speed faster. The pump is located behind the drive unit and requires no maintenance.

The pump comes on when **START** is pressed and the chamber door is closed. Vacuum vents when the time display reaches zero or when **STOP** is pressed at the end of a run. (In the ZONAL operating mode, vacuum vents when the unloading speed is entered.)

To maintain good vacuum in the chamber, the sealing gasket around the top of the chamber must be clean, in good condition, and unlubricated. Rotor O-rings, however, should be lightly lubricated with silicone vacuum grease. If there is a loss of vacuum due to sample leakage, a poor vacuum seal, or a pump failure, the diagnostic message **VAC** will flash on the control panel to signal the condition. The run will *not* be aborted for this reason alone; however, poor vacuum can contribute to poor temperature control and possibly lead to a **TEMP** diagnostic and an overtemp shutdown.

ROTOR CHAMBER

The rotor chamber is stainless steel for durability and corrosion resistance. The chamber is sealed by a silicone rubber gasket. Visible in the chamber are the rotor drive spindle and the temperature sensing thermistor.

The four portholes on the left and right chamber walls allow electrical and liquid lines to enter the chamber for use of rotors that are loaded or unloaded while in the chamber. Use of the portholes is described in the JE-6B and the JCF-Z rotors instruction manuals.

ROTORS

All of Beckman's currently produced J-21 rotors can be used in the Model J2-21M. The J2-21M is programmed to recognize these rotors by the numbers in their names. The operator uses the **ROTOR** parameter entry key to enter the numbers into the microprocessor before a run. Specific information on each rotor can be found in the rotor instruction bulletin which accompanies the rotor. Some general information about available rotors can be found in the rotor book shipped with this manual.

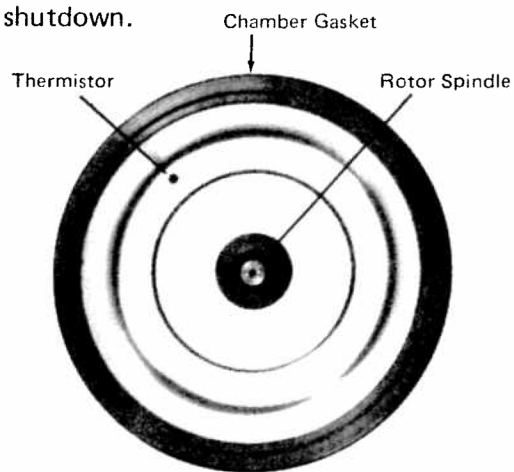


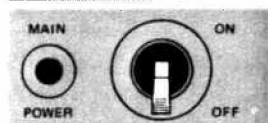
Figure 2. Centrifuge Door Opened, Showing Rotor Chamber

Operation

2

The J2-21M operates in the NORMAL, ZONAL, and PROGRAM LOCK modes. To operate in NORMAL and ZONAL, enter ROTOR, SPEED, TIME, and TEMP. The ACCEL, DECEL, and COMP ADJ parameters are optional. Run conditions are entered using the parameter entry keys and the keyboard. Once entered, a set of run conditions can be stored under a program number for future use. Run parameters are then entered by selecting a program.

The PROGRAM LOCK mode is used to operate the centrifuge using one program only. In PROGRAM LOCK, **ENTER/RECALL**, **START**, and **STOP** are the only functional control panel keys.



POWER

The main POWER switch controls primary power to the centrifuge. Power must be ON before the chamber door can be opened or closed. Do not use the POWER switch to abort a run; use the **STOP** switch.

NOTE: The last used parameter values are retained in the microprocessor even if POWER is turned off.



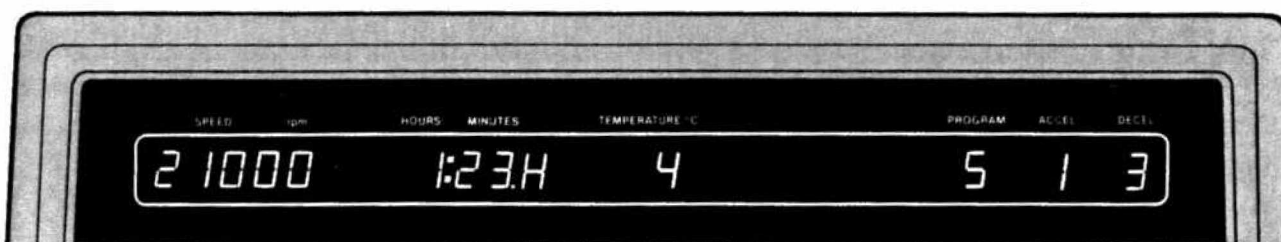
KEY SWITCH

The four positions of the key switch control microprocessor operating modes.

1. NORMAL Turn the key to NORMAL for routine closed-door centrifugation.
2. ZONAL Turn the key to ZONAL for open-door operation below 3000 rpm for use of the JCF-Z rotor. The key cannot be removed from the lock when in ZONAL. There is no overtemp diagnostic when the key is in ZONAL.

3. PROGRAM LOCK Turn the key to PROGRAM LOCK for operation according to the last recalled program *only*. Parameters cannot be changed and diagnostic messages cannot be cleared until the key is first turned to NORMAL.
4. LOCK The centrifuge will not operate when the key is in LOCK.

The key can be turned to NORMAL, PROGRAM LOCK, or LOCK and then removed from the centrifuge.

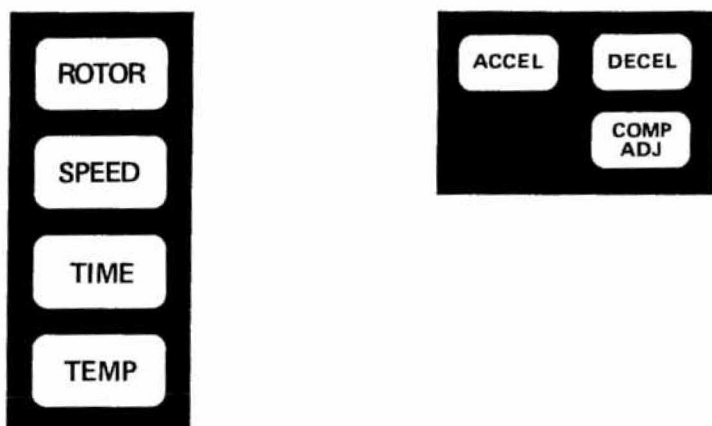


DIGITAL DISPLAYS

Digital displays indicate exactly what the centrifuge is doing.

- rotor speed
- run time remaining or elapsed
- rotor temperature
- program number selected
- acceleration and deceleration numbers selected

Digital displays also show keyboard entries. Pressing a parameter entry key



10

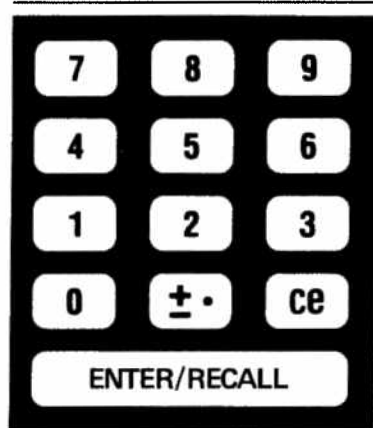
flashes the digits in the display to be changed, and displays other entered parameter values. *Flashing digits* indicate that the parameter can be changed.

The digits stop flashing when

- **ENTER/RECALL** is pressed, entering the digits into the microprocessor, or
- a different parameter entry key is pressed, entering the digits into the microprocessor.

Rapidly flashing digits indicate operator error (i.e., speeds greater than the rotor's maximum, speeds greater than 21 000 rpm, temperatures greater than 40°C, etc.) and will continue to flash until **CE** is pressed and new digits are selected.

Pressing **ENTER/RECALL** at any time displays for 3 seconds the run conditions that have been entered for the run. After the 3 seconds, the displays again show what the centrifuge is doing.



KEYBOARD

The keyboard is used for the numerical entry of the run parameters. There are switches for digits 0 through 9.

±· plus/minus/decimal point key

The decimal point is activated when entering ROTOR and TIME. The minus sign is activated when entering TEMP and COMP ADJ. The minus sign is removed by pressing the key again. (A plus sign is not displayed.)

ENTER/RECALL enter and recall key

- Enters selected keyboard digits into the memory. Unacceptable keyboard digits will *rapidly flash* in the display until cleared; they cannot be entered.
- Recalls entered run parameters into the digital displays for 3 seconds.

CE clear entry key

- Clears the last keyboard entry—and 0 flashes in the display.
- Clears an input to change a parameter when used after pressing **ROTOR**, **SPEED**, **TIME**, or **TEMP**—and the display again indicates what the centrifuge is doing.
- Clears ACCEL, DECEL, and COMP ADJ displays when used after pressing their parameter entry key—and “-” flashes in the display.
- Clears diagnostic messages.

ROTOR

To enter the rotor numbers:

1. Press **ROTOR**. The word "ROTOR" flashes below the SPEED display and the display flashes.
2. Press the keyboard digits corresponding to the numbers in the rotor name, as listed in Table 1.

Example: To identify the JA-20.1 rotor

press **2** and "2" flashes

press **0** and "20" flashes

press **±** and "20." flashes

press **1** and "20.1" flashes

3. Check the display. If the entry is incorrect, press **CE** and reenter the digits.
4. Press **ENTER/RECALL** or press the next parameter entry key.

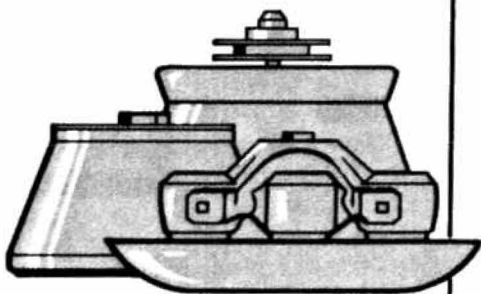
The rotor must be identified before the run. Identifying the rotor provides:

- *Automatic maximum speed limits.* A speed greater than the rotor's maximum cannot be entered for the run speed. If the rotor exceeds this maximum during the run, the diagnostic SPEED will flash on the control panel and the rotor will decelerate to a stop.
- *Temperature compensation.* The displayed temperature will be rotor temperature.
- *Speed memory automatically resets to zero.* A run speed must be entered after entering the rotor numbers.

The rotor numbers can be recalled to the display only by pressing **ROTOR** again. Pressing **ENTER/RECALL** displays set speed, not rotor numbers.

Table 1. Rotors for the Model J2-21M—
ROTOR Parameter Key Entry

Rotor	ROTOR Entry	Maximum Speed (rpm)
JA-21	21	21 000
JA-20.1	20.1	20 000
JA-20	20	20 000
JA-18.1	18.1	18 000
JA-18	18	18 000
JA-17	17	17 000
JA-14	14	14 000
JA-10	10	10 000
JS-13.1	13	13 000
JS-13	13	13 000
JS-7.5	7.5	7 500
JV-20	20.2	20 000
JE-6B	6.0	6 000
JCF-Z	20.9	20 000



SPEED

Before entering SPEED, you must enter ROTOR. To enter speed:

1. Press **SPEED**. The SPEED display flashes.
2. Press the keyboard digits corresponding to the desired speed (100 to 21 000 rpm).

Example: To select 20 000 rpm

press **2** and "2" flashes

press **0** and "20" flashes

press **0** and "200" flashes

press **0** and "2000" flashes

press **0** and "20000" flashes

3. Check the SPEED display. If the entry is incorrect, press **CE** and reenter the digits.
4. Press **ENTER/LOCAL** or press the next parameter key. The display will indicate operator error—*rapidly flashing digits*—if the speed is greater than the rotor's maximum speed. Press **CE** and reenter the digits.

Run speed can be changed at any time during the run (except when the key switch is turned to PROGRAM LOCK), and the rotor will accelerate or decelerate to the selected speed.

TIME

To enter run time:

1. Press **TIME**. The TIME display flashes.
2. Press the keyboard digits for the desired time (0 to 99 hours 59.9 minutes, or larger values to designate a *hold* run, i.e., 9999). Tenths of minutes are entered only by first pressing **±**.

Example: To enter 1 h 20 min

press **1** and ": 1.0" flashes

press **2** and ":12.0" flashes

press **0** and "1:20.0" flashes

To add 0.5 min to this time

press **±** and press **5** "1:20.5" flashes

Example: To designate *hold*

press **9** four times and "99:99.0" flashes

3. Check the TIME display. If the entry is incorrect, press **CE** and reenter the digits.

4. Press **ENTER/RECALL** or press the next parameter key.

The TIME display *counts up in minutes from zero* (changing every minute) if a hold run is designated. A capital H will be displayed in the tenths position of the display when **START** is pressed. **STOP** must then be used to terminate the run.

The TIME display *counts down in tenths of minutes* (changing every 6 seconds) from an entered time—0 to 99 hours 59.9 minutes. Selecting 99 minutes will convert to 1 hour 39 minutes when **START** is pressed. The run terminates when the TIME display reaches zero. In both cases, the display starts counting when **START** is pressed.



To enter temperature:

1. Press **TEMP**. The TEMPERATURE display flashes.
2. Press the keyboard digits for the desired temperature (-20° to 40°C). Press **\pm** for a minus sign. Press the key a second time to remove the minus sign. A plus sign is not displayed.

Example: To select -4°C
 press **\pm** and "-0" flashes
 press **4** and "-4" flashes

3. Check the TEMPERATURE display. If the entry is incorrect, press **CE** and reenter the digits.
4. Press **ENTER/RECALL** or press the next parameter entry key.

During the run, the display will indicate *rotor* temperature.



The acceleration/deceleration rates are listed in Table 2 by keyboard number. If selected for the run, the keyboard number will be displayed in the ACCEL/DECEL display area. If no rates are selected, the maximum rates will be used for the run and no numbers will appear in the displays.

To select an acceleration rate:

1. Press **ACCEL**. The ACCEL display flashes.
2. Press the keyboard digit for the desired time, independent of the rotor and load being used (digits 1 through 9).
3. Press **ENTER/RECALL** or press another parameter entry key.

To select a deceleration rate:

1. Press **DECEL** . The DECEL display flashes.
2. Press the keyboard digit for the desired time, independent of the rotor and load being used (digits 1 through 9 or select digit 0 for deceleration from maximum speed with *no brake*).
3. Press **ENTER/RECALL** .

The acceleration times are the times it takes a rotor to reach 500 rpm from rest. At 500 rpm, maximum acceleration takes over and the rotor quickly reaches the selected speed. The deceleration times are the times it takes a rotor to decelerate from 500 rpm to rest. From maximum speed to 500 rpm, the rotor will decelerate with full dynamic braking. For a coasting stop from maximum speed, select 0 as the deceleration rate.

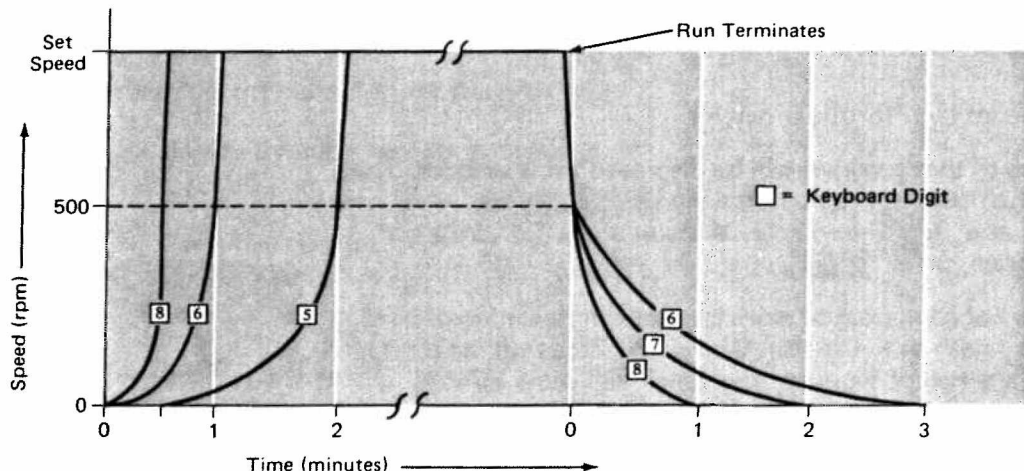
NOTE: To clear an ACCEL or DECEL entry, press the parameter entry key **ACCEL** or **DECEL** , press **CL** , and then press **ENTER/RECALL** . There will be no number in the display, and the maximum rate will be used for the run.

Table 2. Acceleration Rates and Deceleration Rates

Keyboard Digit	ACCEL time from 0 to 500 rpm	DECEL time from 500 to 0 rpm
1	10 minutes	15 minutes
2	6 minutes	12 minutes
3	4 minutes	9 minutes
4	3 minutes	6 minutes
5	2 minutes	4 minutes
6	1 minute	3 minutes
7	45 seconds	2 minutes
8	30 seconds	1 minute
9*	15 seconds	30 seconds

*Not achieved with heavy rotors.

NOTE: If no rates are selected, maximum rates will automatically be used for the run.



Examples of ACCEL and DECEL Rates



The **COMP ADJ** key is used to add to or subtract from the temperature compensation values used by the microprocessor to calculate rotor temperature.

If the results of a dynamic temperature calibration (described in MAINTENANCE) indicate that the rotor is warmer or cooler than the displayed temperature, use the COMP ADJ key to adjust the compensation values. For example, if a dynamic calibration shows that the rotor is -6°C and the display showed -4°C , the rotor was too *cold* and 2° should be added to the compensation values (i.e., +2 is the COMP ADJ). If the rotor is too *warm*, subtract the temperature difference (i.e., use negative COMP ADJ digits).

To add to or subtract from the temperature compensation value:

1. Press **COMP ADJ**. The word "COMP" flashes below the TEMPERATURE display and the display flashes.
2. Press the keyboard digit for the number of compensation digits. Press **±** for a minus sign; press it again to remove the minus sign.
3. Check the TEMPERATURE display. If the entry is incorrect, press **CE** and reenter the digits.
4. Press **ENTER/RECALL**.

NOTE: To clear a COMP ADJ entry, press

COMP ADJ, **0**, and **ENTER/RECALL**.



There is storage space for ten sets of run conditions. Each of the sets, or programs, is retained in its memory until the run conditions are changed; program memories are not cleared by pressing the **CE** key. Programs are stored by keyboard number (0 through 9). All programs are retained even if power is turned off.

To recall a program:

1. Press **PROG RECALL**.
2. Press the keyboard digit for the program.

The parameters of that program will be displayed for 3 seconds. The program can then be displayed by pressing **ENTER/RECALL**. (You must press **ROTOR** and **COMP ADJ** to display those entries.) To start a run using this program, press **START**.

If the digit has not been used to store a set of run conditions, the digit will continue to flash in the PROGRAM display. Zeros will be displayed for all parameters except temperature, which will show 25°C .

NOTE: Erasable labels are provided as a program library. They may be fixed to the centrifuge next to the control panel.

PROGRAM LIBRARY	
PROG.	DESCRIPTION/PARAMETERS
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

USE ERASABLE MARKER

To change a program memory:

1. First recall the program.
 - Press **PROG RECALL** .
 - Press the keyboard digit for the program.
2. Press the parameter entry key for the run condition. Both the PROGRAM display and the display corresponding to the parameter entry key will flash.
3. Press the keyboard digits to select the parameter value.

NOTE: DO NOT use **ENTER/RECALL** to enter the digits. Pressing **ENTER/RECALL** will enter the digits into the microprocessor but not into the program memory. See also *To modify a program for a particular run.* If you change ROTOR, you must reenter a speed.

4. Press the next parameter entry key. The first entry will be stored, and the microprocessor will be ready for the next keyboard entry. Proceed again with Step 3.
5. When all entries have been made, press **PROG SAVE** . The digit in the PROGRAM display flashes twice as the parameters are stored in the program. Run conditions appear in the displays for 3 seconds and can then be recalled by pressing **ENTER/RECALL** .
6. To start a run using this program, press **START** .

To modify a program for a particular run:

The program procedure detailed above changes the program memory. You may also recall a program for a particular run and change a run condition, but leave the program memory *unchanged*.

1. First recall the program.
 - Press **PROG RECALL** .
 - Press the keyboard digit for the program.

2. Press the parameter entry key for the change.

NOTE: If you change ROTOR, you must reenter a speed.

3. Press the keyboard digits to select the parameter value.
4. Press **ENTER/RECALL** .

The parameter values entered for the run will be displayed for 3 seconds. The PROGRAM display clears and that program remains unchanged. To start a run using this set of run conditions, press **START** .



Press **START** to start a run. The green light above the switch indicates that the rotor is accelerating or at speed. (For repeat runs and all runs in the PROGRAM LOCK mode, press **ENTER/RECALL** then **START** to start the run.)



Press **STOP** to terminate a run. The green light above the switch indicates that the rotor is decelerating. The light goes out and an audible tone is heard (end-of-the-run-buzzer) when the rotor stops.



NORMAL RUN MODE

POWER must be ON before the chamber door can be opened. Carefully install the rotor on the drive spindle. For low-temperature work, it is best to refrigerate the rotor before the run.

Turn the key switch to NORMAL. In NORMAL, operate the J2-21M by recalling one of your ten established programs,² or by selecting the desired run conditions using the keyboard and the parameter entry keys. The latter will be called manual operation.

Manual

- Enter: ROTOR, SPEED, TIME, and TEMP.
- Enter optional parameters if desired: ACCEL, DECEL, COMP ADJ.
- Press **ENTER/RECALL** for verification of all entries.
- Press **START**.

Any run parameter, except ROTOR, can be changed during the run. Press **STOP** to terminate a *hold* run; timed runs terminate when the TIME display reaches zero. After the rotor stops, signaled by an audible tone, open the chamber door and remove or empty the rotor.

For repeat runs, press only **ENTER/RECALL** and **START**.

Program

- Press **PROG RECALL**.
- Press the keyboard digit for the desired program.
- Press **START**.

²See **PROG RECALL** **PROG SAVE** earlier in this section.

Any run parameter, except ROTOR, can be changed during the run. The program being used can also be changed during the run. Any program with the same ROTOR entry can be recalled to the microprocessor and the centrifuge will then operate according to that program.

Press **STOP** to terminate a *hold* run; timed runs will terminate when the TIME display reaches zero. After the rotor stops, signaled by an audible tone, open the chamber door and remove or empty the rotor.

For repeat runs, press only **ENTER/RECALL** and **START**.



PROGRAM LOCK RUN MODE

POWER must be ON before the chamber door can be opened. Carefully install the rotor on the drive spindle. For low-temperature work, it is best to refrigerate the rotor before the run.

PROGRAM LOCK is a special operating mode used to operate the centrifuge according to the last recalled program only. Once the desired run conditions are saved under a program number, turn the key switch to PROGRAM LOCK. Remove the key from the lock if desired. **ENTER/RECALL**, **START**, and **STOP** are the only functional keys on the control panel when in PROGRAM LOCK.

Program Lock

- Press **ENTER/RECALL**.
- Press **START**.

NOTE: If the **STOP** switch is used to terminate a PROGRAM LOCK run, the diagnostic message RESET will flash on the control panel. To clear flashing messages, first turn the key switch to NORMAL, then press **STOP**.



ZONAL RUN MODE

POWER must be ON before the chamber door can be opened. Carefully install the rotor on the drive spindle. For low-temperature work, it is best to refrigerate the rotor before the run.

Turn the key switch to ZONAL. The ZONAL operating mode is used for loading and unloading the JCF-Z rotor with the chamber door open.

Loading

- Enter: 20.9 for the JCF-Z rotor for ROTOR
2000 rpm for SPEED
9999 for TIME
TEMP as desired
- Enter optional parameters if desired: ACCEL, DECEL, COMP ADJ.
- Press **START** .
- When the rotor is spinning at 2000 rpm, load the rotor.
- After loading, remove the fittings and liquid lines from the chamber.
Reinstall stoppers in all portholes.

Acceleration

NOTE: Always close the chamber door *before* increasing the speed. If you reverse these steps, you will cause a DOOR diagnostic.

- Close the chamber door.
- Enter the run SPEED. The vacuum system comes on.

The rotor accelerates to the set speed. Use an auxiliary timer to alert the operator of the end of the high speed part of the run.

Unloading

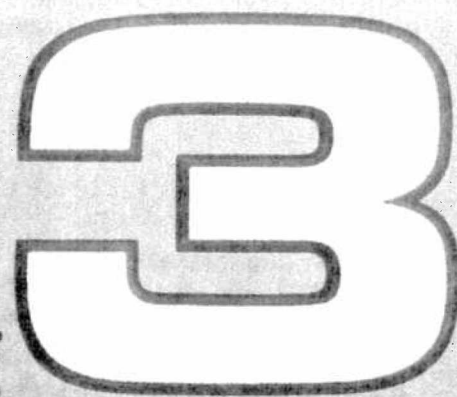
- Enter: 2000 rpm for SPEED.
Vacuum vents, the rotor decelerates to 2000 rpm, and the door unlocks.
- Open the chamber door and unload the rotor.
- After unloading, press **STOP** .

Points to Remember

- Keep the rotor chamber clean and dry.
It is best to defrost the chamber daily—leave the door open with power off—and sponge out the moisture.
- Close the chamber door between low-temperature runs to reduce condensation in the chamber.
- Refer to TROUBLESHOOTING if a diagnostic message flashes on the panel.
- Be careful when installing heavy rotors.

Lower and lift rotors vertically to avoid bending the spindle.
Do not put a wet rotor on a cold spindle; the rotor will stick to the spindle.

Troubleshooting



In the event of certain abnormal conditions, one of the following diagnostic messages will flash on the control panel: POWER, BELT, DOOR, IMBAL, SPEED, RESET, VAC, TEMP. The message will flash until the **CE** switch is pressed. In the case of the BELT, DOOR, IMBAL, and SPEED diagnostics, the drive cannot be restarted until the condition is corrected.

NOTE: If the key switch is in PROGRAM LOCK, turn the key to NORMAL and then press **CE** to clear a flashing message.

This section details each diagnostic message and other troubleshooting procedures.

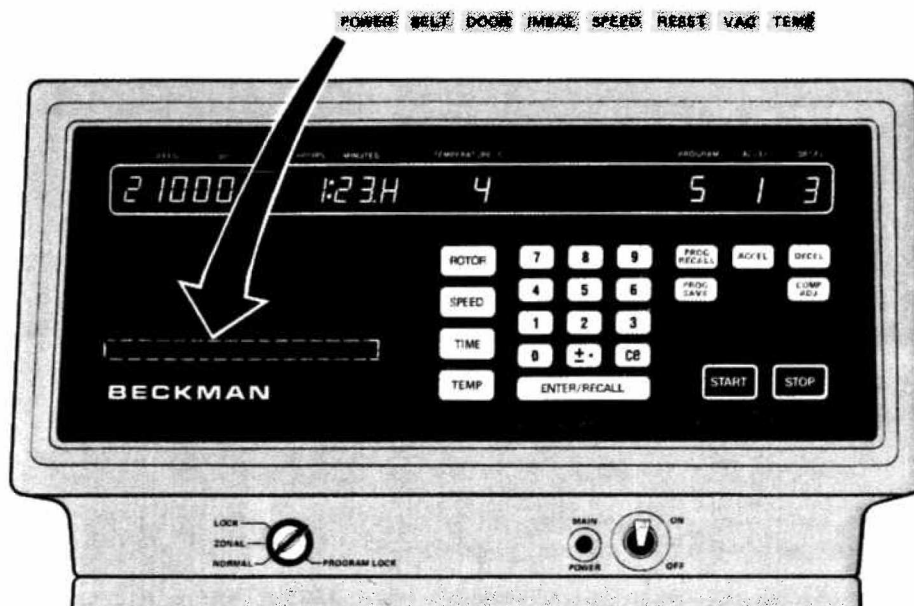


Figure 3. Location of the Diagnostic Messages on the Control Panel

DIAGNOSTIC MESSAGES

POWER flashing

There was a power failure.

If facility power failed only momentarily, the rotor will accelerate back to speed and the run will continue. The message flashes until **CE** is pressed, alerting the operator of the interruption.

If the power failure was long enough to allow the rotor to coast to a stop, the run will not continue when power is restored. Press **CE**, **ENTER/RECALL**, and **START** to restart the run (from the beginning).

BELT flashing

The drive belt is broken.

Allow the rotor to coast to a stop (wait at least 20 minutes). The drive belt must be replaced before the centrifuge will operate again. Instructions are provided in MAINTENANCE. Press **CE** and turn POWER OFF.

DOOR flashing

The chamber door is open.

For NORMAL and PROGRAM LOCK operating modes, close the door. Press **CE**, **ENTER/RECALL**, and **START**.

For the ZONAL operating mode: (1) Be sure the key switch is turned to ZONAL. (2) The rotor cannot be accelerated beyond 3000 rpm with the door open. The rotor will be coasting to a stop. The door latch is locked. Press **CE**. Then enter a speed less than 3000 rpm. When speed is less than 3000 rpm, close the chamber door, reset the desired run speed, press **ENTER/RECALL** and **START**. If BELT now flashes, see above.

IMBAL flashing

The rotor is unbalanced.

Allow the rotor to brake to a stop. Then open the door and check the rotor for proper loading. Do not restart the run until you are sure the rotor is symmetrically loaded. To restart the run from the beginning, press **CE**, **ENTER/RECALL**, and **START**.

SPEED flashing

The rotor has exceeded its maximum rated speed.

Allow the rotor to coast to a stop. Press **CE** and turn POWER OFF. Call your local Beckman Field Service Representative; there has been a speed controller malfunction.

RESET flashing

STOP was pressed while operating in PROGRAM LOCK.

The rotor will decelerate according to the program. To clear the message, turn the key to NORMAL and then press **CE**. To start the next run, turn the key back to PROGRAM LOCK, press **ENTER/RECALL** and **START**.

VAC flashing

Chamber vacuum is poor.

Loss of vacuum may be due to a dirty chamber gasket, sample leakage, or leakage around the portholes in the chamber wall while using the JCF-Z rotor. Press **CE** to clear the message. After the run, check for leakage. Clean the

TEMP flashing

The refrigeration system is not cooling and rotor temperature has exceeded set temperature by more than 4°C.

or

The rotor chamber has exceeded 45°C.

chamber gasket with a tissue and 70% ethanol (do not grease it). Also, check that the vacuum bottles are tightly screwed into their lids (location shown in the foldout illustration at the back of this manual).

Poor vacuum results in rotor heating and poor temperature control. Continued vacuum problems should be brought to the attention of the Beckman Field Service Representative.

The rotor will decelerate to a stop. Press **CE** and turn POWER OFF. Call your Beckman Field Service Representative; there has been a refrigeration malfunction.

NOTE: This diagnostic is not operative when the key switch is in ZONAL.

OTHER PROBLEMS

Rotor seems too warm or too cold.


To verify the accuracy of temperature control, perform a dynamic temperature calibration (described in MAINTENANCE). It may be necessary to adjust the automatic temperature compensation when using that rotor at that speed and temperature. Low temperatures cannot be achieved with all rotors at all speeds.

Centrifuge will not start.

1. Check the key switch. The centrifuge will *not* operate with the key in LOCK.
2. Press **ENTER/RECALL** and then press **START**.
3. Clear any flashing messages.
4. Be sure to enter ROTOR, then SPEED, TIME, and TEMP. When ROTOR is entered, the run speed automatically resets to zero.

Rotor is stuck to the spindle.

Allow the rotor to come to room temperature and then try to remove it. If it is still stuck, use the T-bar removal tool (part number 338896). First remove the rotor lid. For JA-17, -20, -20.1, and -21 rotors, also remove the small O-ring and slide the aluminum collar (338689) sideways into the empty O-ring groove. Then screw the removal tool into the center of the rotor to separate the rotor from the spindle. Lift the rotor out. To avoid this problem, keep the spindle lightly lubricated with Spinkote™.



Maintenance and Installation Requirements

4

All maintenance procedures contained here can be safely performed by qualified personnel. Maintenance not covered in this manual should be performed only by a Beckman Field Service Representative. Limited emergency service under warranty is available from Beckman for the first year only. Service is available from Beckman on a fee basis after that period.

CLEANING

The centrifuge door is finished with urethane paint; other painted surfaces are finished with vinyl paint. Clean with a mild detergent solution. Disinfect with 70% ethanol.³

The control panel is coated with a Mylar finish. Use only water on the control panel.

The rotor chamber is stainless steel and the gasket is silicone rubber. Clean the chamber with detergent solution and rinse well. Disinfect with 70% ethanol if necessary. Be sure the gasket is clean and in good condition; do not lubricate it. Periodically lubricate the top of the rotor drive spindle with Spinkote. This will prevent rotors from sticking to the spindle.

DEFROSTING

The rotor chamber should be defrosted *daily* if routine low-temperature work is being done. Leave the door open with POWER OFF overnight to defrost. Then sponge up the water in the chamber the next morning. To melt ice buildup more quickly, set the temperature for 40°C and run a rotor at maximum speed for 5 minutes. Then remove the rotor and sponge up the water.

REPLACING THE AIR FILTER

A disposable filter is installed over the air intake at the back of the centrifuge to prevent dust from plugging the air passages. The filter must be replaced every one to three months as dirt accumulates. Discard the old filter and use any commercially available filter (about 400 by 600 mm; 16 x 25 in.) that covers the intake area.

³ Turn POWER OFF before using ethanol or any flammable liquid on or near the centrifuge.

If the diagnostic message BELT is flashing on the control panel, replace the drive belt. When the SPEED display indicates 0 rpm, turn POWER OFF.

WARNING

Unplug the centrifuge or turn off and lock out the main wall circuit breaker before removing an instrument panel.

1. Remove the lower front panel by unscrewing the two nuts under the bottom edge of the panel with a 12-mm (7/16-in.) wrench. Visually confirm that the pulleys have stopped turning (refer to the foldout illustration at the back of this manual).
2. Find the broken belt and remove it.
3. Locate the gray cable labeled "R" under the spindle pulley. Squeeze the tabs on the plastic connector labeled "RTR" and pull the connector apart.
4. To install a new belt (870961), first put the gray cable through the belt and then fit the belt into the spindle pulley groove. Keep the serrated surface of the belt to the outside. With your left hand hold the belt taut, stretching it toward the motor pulley. With your right hand push against the motor to extend the spring, then fit the belt into the groove around the motor pulley. Gradually release the motor, and spring tension will tighten the belt.
5. Turn the motor pulley three or four turns clockwise to be sure the belt is in the groove and not twisted.
6. Reconnect the "RTR" plastic connector.
7. Locate the drive belt safety interlock. Reconnect it.
8. Install the front panel and then plug in the centrifuge.
9. Turn POWER ON, press **CE**, and make a brief test run—accelerate to speed and then decelerate—to verify that the centrifuge functions normally.

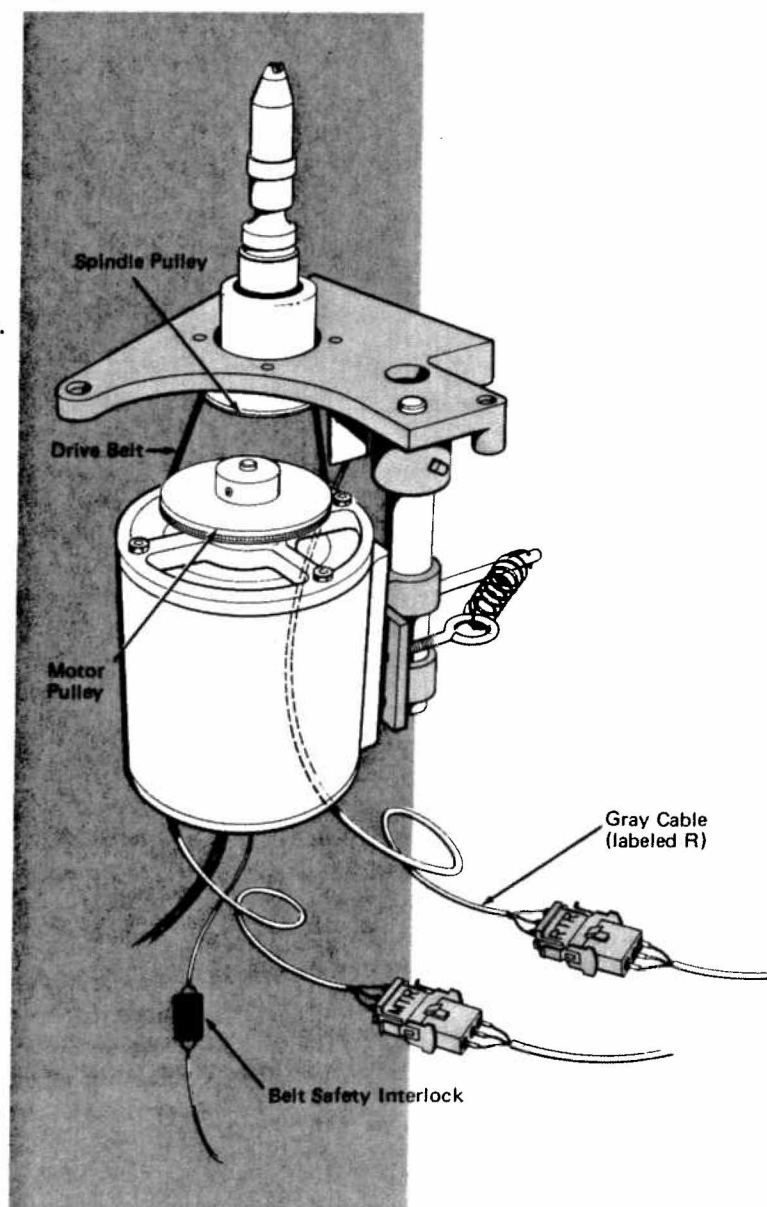


Figure 4. Replacing the Drive Belt

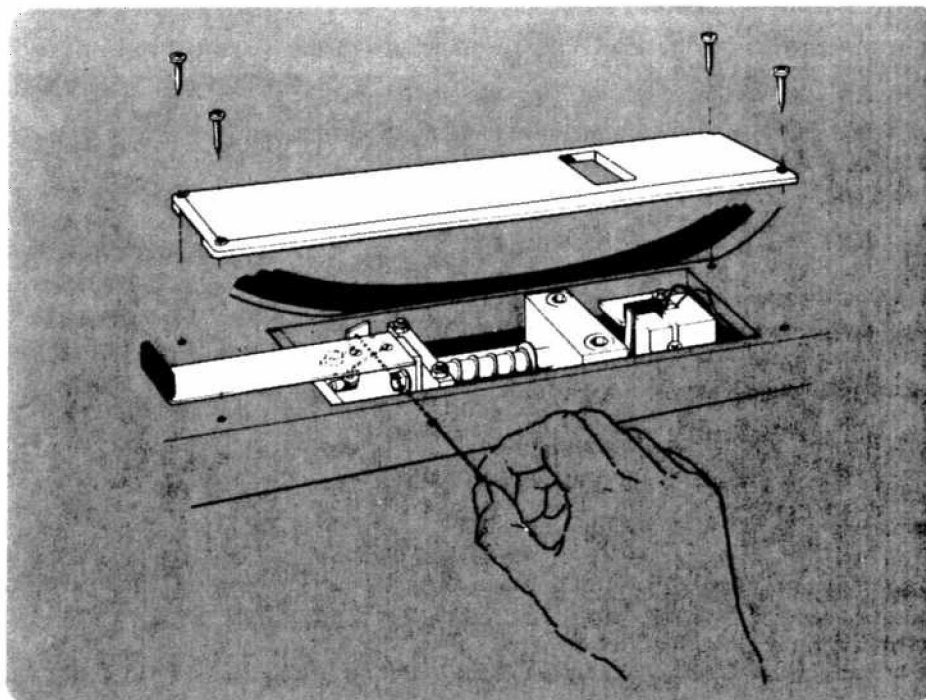


Figure 5. Tripping the Door Lock

POWER FAILURE: TRIPPING THE DOOR LOCK

WARNING

Turn POWER OFF before proceeding.

Allow at least 20 minutes for the rotor to coast to a stop. (The digital display and the brake will be inoperative with the power out.) To trip the door lock, insert a thin wire such as a straightened paper clip one inch *straight* through the hole below the chamber door handle. While holding the wire in the hole, pull the door latch lever forward and then lift up on the handle.

TEMPERATURE CALIBRATION

To verify the accuracy of the temperature sensing system and the refrigeration system, perform a dynamic calibration. The results of this test may indicate that a compensation adjustment is necessary for temperature control to within 1°C.

Test the rotor at the run speed and temperature desired for sample separation. You will need a thermometer calibrated in 0.2°C, and two large bottles or tubes of water. *Precool* the rotor and water to the approximate run temperature.

1. Turn POWER ON and turn the key switch to NORMAL.
2. Open the chamber door and install the precooled rotor. Load two tubes or bottles containing equal volumes of water into opposing rotor positions. Then close the chamber door.
3. Enter the **MODE** numbers.
4. Enter **SPEED** and **TEMP**. Enter 9999 for **TIME**.
5. Press **START**.

6. After about one hour of centrifugation, record the temperature in the digital display. Then press **STOP**.
7. As soon as the STOP light goes out, open the chamber door and immerse the thermometer into one of the water-filled containers to precool it. Then measure and record the temperature of the second water-filled container.
8. Compare the two recorded temperatures. If the rotor is warmer or cooler than the *displayed* temperature, add or subtract the temperature difference using the **COMP ADJ** key when repeating these run conditions.
 - If the rotor is warmer, enter negative digits.
 - If the rotor is cooler, enter positive numbers. (A plus sign is not displayed.)

Refer to the discussion under **COMP ADJ** in OPERATION.

NOTE: This calibration should be performed for each rotor at run speed and temperature before using the **COMP ADJ** key. Once determined, enter the COMP ADJ digits for each run that uses the same rotor and same run conditions.

ELECTRICAL REQUIREMENTS

Preinstallation requirements are shipped to the purchaser prior to shipment of the centrifuge. The Model J2-21M is installed by a Beckman Field Service Representative. Electrical and location requirements are outlined here in case the centrifuge must be relocated.

The voltage on the name rating plate on the back of the centrifuge should agree with the measured line voltage. The Beckman Representative can rewire the centrifuge, if necessary, to adapt it to the available voltage. He also provides a new name rating plate. The Model J2-21M requires 208- to 240-V power, fused for 30 A. The system includes earth ground and two leads with circuit protectors.

Range for 208-V, 60-Hz unit	187 - 223 V
Range for 240-V, 60-Hz unit	224 - 264 V
Range for 220-V, 50-Hz unit	210 - 224 V

NOTE: The cord on 50-Hz units is not equipped with a plug, so both a receptacle and a plug complying with local electrical standards must be supplied.

LOCATION REQUIREMENTS

Select a location with good ventilation and a level floor. *Maintain the minimum required clearances.* The instrument will operate within stated specifications in an ambient temperature range of 16° to 38°C.

1. To move the centrifuge, first unplug the power cord and use a 19-mm (3/4-in.) wrench to raise the two front feet. As the feet screw into the instrument, the caster foot lowers until the instrument will roll freely.

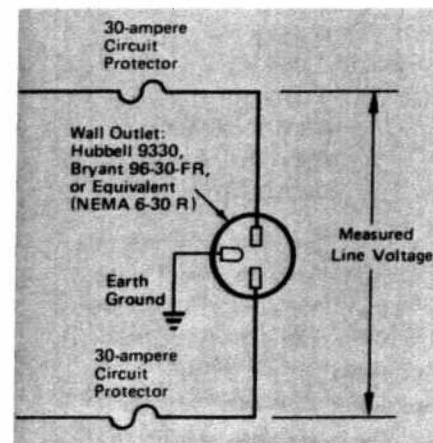


Figure 6. Electrical Requirements

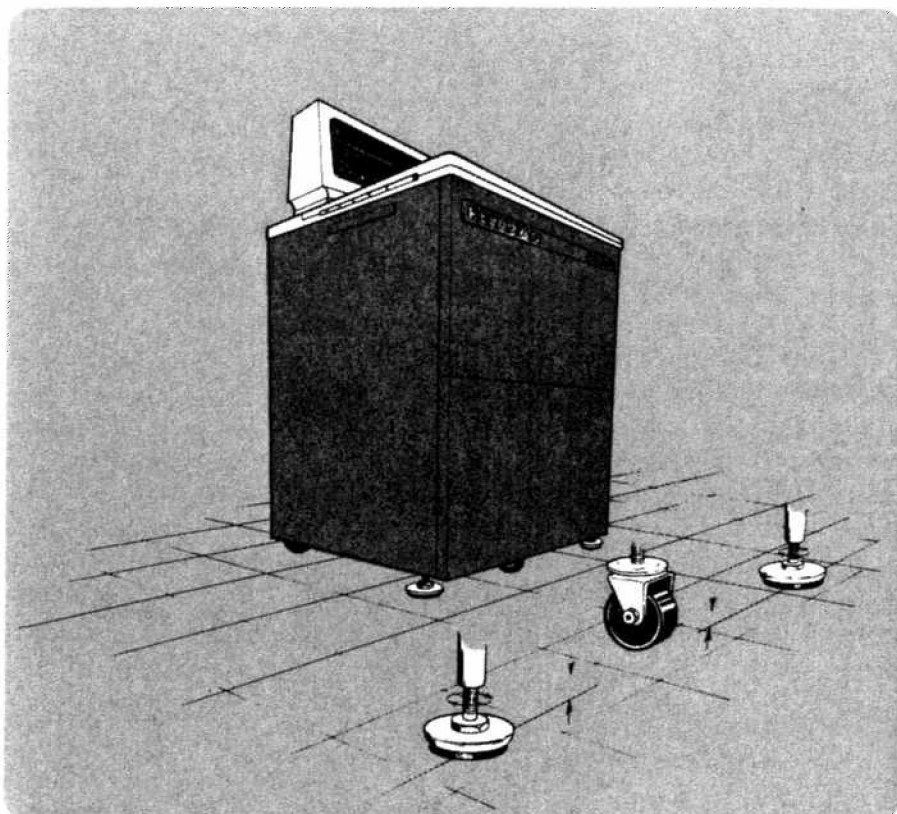
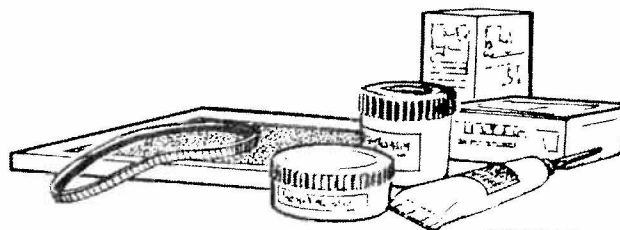


Figure 7. Adjusting the Leveling Feet

2. Roll the centrifuge back-first to the installation site. *Push against the front of the instrument only; do not push on the control panel.* The rear casters do not swivel.
3. Readjust the front feet until the front caster is off the floor and the instrument is level to the eye. Be sure both front feet are firmly in contact with the floor.
4. Check the line voltage required.
5. With the power switch off, plug in the power cord.



SUPPLY LIST

Filters, for the air intake area	885218
Drive belt	870961
Solution 555	339555
Rotor Cleaning Kit	339558
Spinkote lubricant	306812
Silicone vacuum grease	335148

For information on J-21 rotors, tubes, bottles, and adapters, see Parts List PL-564 and the Rotors, Tubes, and Accessories catalog (PL-367). These are available free from the Spinco Division Marketing Department or from your local sales and service office.

WARRANTY FOR THE MODEL J2-21M CENTRIFUGE

Subject to the exceptions and upon the conditions specified below, Beckman agrees to correct, either by repair, or, at its election, by replacement, any defects of material or workmanship which develop within one (1) year (three [3] years for the drive motor) after delivery of the Model J2-21M Centrifuge (the product), to the original Buyer by Beckman or by an authorized representative, provided that investigation and factory inspection by Beckman discloses that such defect developed under normal and proper use.

Some components and accessories by their nature are not intended to and will not function for one (1) year. If any such component or accessory fails to give reasonable service for a reasonable period of time, Beckman will repair or, at its election, replace such component or accessory. What constitutes either reasonable service and a reasonable period of time shall be determined solely by Beckman.

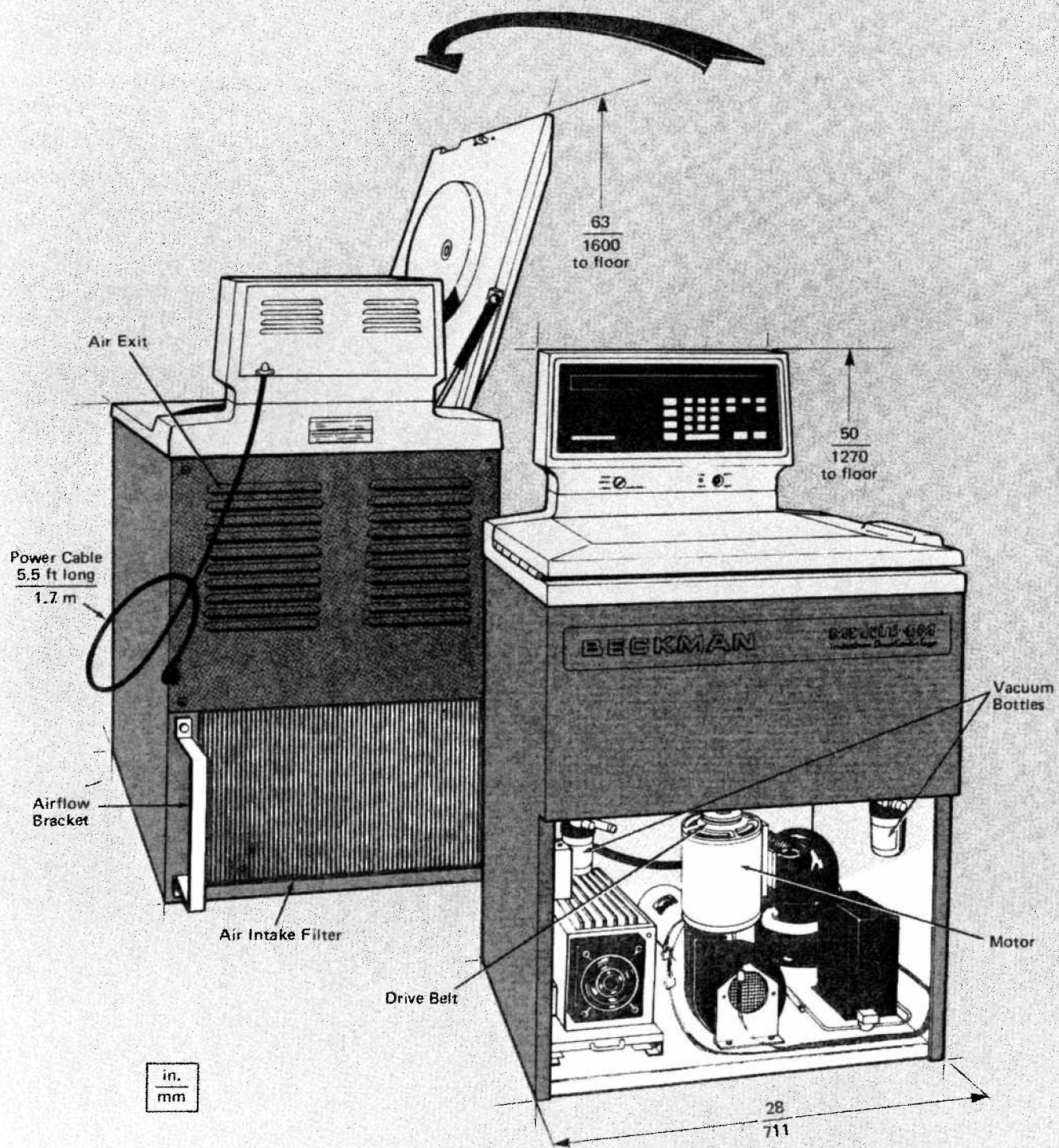
Any product claimed to be defective must, if requested by Beckman, be returned to the factory, transportation charges

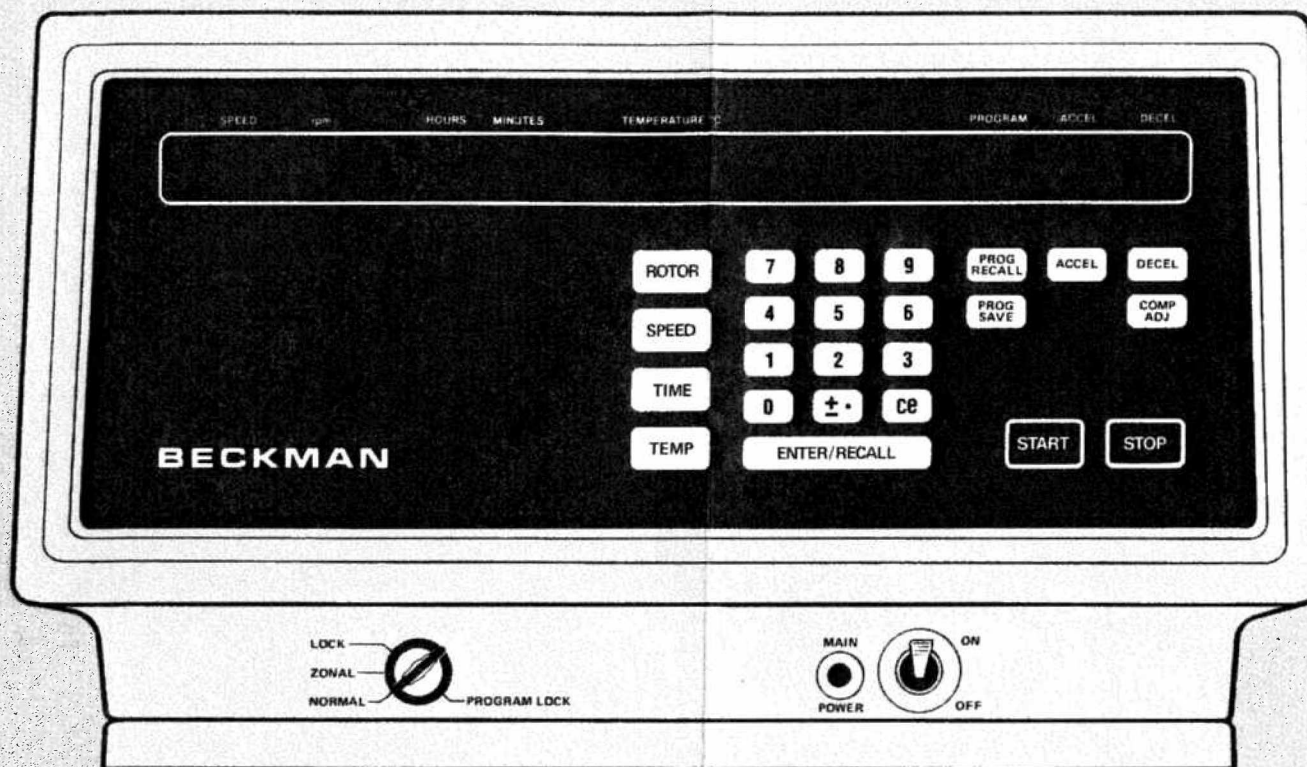
prepaid, and will be returned to Buyer with the transportation charges collect unless the product is found to be defective in which case Beckman will pay all transportation charges.

Beckman makes no warranty concerning products or accessories not manufactured by it. In the event of failure of any such product or accessory, Beckman will give reasonable assistance to the Buyer in obtaining from the respective manufacturer whatever adjustment is reasonable in light of the manufacturer's own warranty.

Beckman shall be released from all obligations under all warranties either expressed or implied, if the product covered hereby is repaired or modified by persons other than its own authorized service personnel, unless such repair by others is made with the written consent of Beckman, or unless such repair in the sole opinion of Beckman is minor, or unless such modification is merely the installation of a new Beckman plug-in component for such product.

IT IS EXPRESSLY AGREED THAT THE ABOVE WARRANTY SHALL BE IN LIEU OF ALL WARRANTIES OF FITNESS AND OF THE WARRANTY OF MERCHANTABILITY AND THAT BECKMAN SHALL HAVE NO LIABILITY FOR SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY KIND WHATSOEVER ARISING OUT OF THE MANUFACTURE, USE, SALE, HANDLING, REPAIR, MAINTENANCE, OR REPLACEMENT OF THE PRODUCT.





Operating Reminder

- To recall a program: (1) press **PROG RECALL**, (2) press the keyboard number for the program.
- To change a program memory: (1) press **PROG RECALL**, (2) press the keyboard number for the program to be changed, (3) press the parameter entry key for the run condition to be changed, (4) press the keyboard digits for the run condition, (5) either press **PROG SAVE** or press the next parameter entry key to make additional changes.
- Do not use **ENTER/RECALL** to enter run conditions into a program memory; use only **PROG SAVE** and parameter entry keys.
- To clear the **PROGRAM** display and place the displayed program back into memory without changing it, change or clear any run condition using **ENTER/RECALL**.
- The chamber door cannot be opened or closed with **POWER OFF**.
- The centrifuge will not operate with the key switch in **LOCK**.
- To display selected run conditions: press **ENTER/RECALL**.
- To enter a run condition: (1) press the parameter entry key, (2) press the keyboard digits for the run condition, (3) press **ENTER/RECALL** or press another parameter entry key.
- Entering the rotor numbers automatically resets the speed to zero. Therefore, always enter **ROTOR** before entering **SPEED**. The rotor entry cannot be changed *during* a run.
- Run conditions are retained until changed or cleared. The last used run conditions are retained even if **POWER** is turned **OFF**.

Rapidly flashing digits: operator error. Press **CE** and reenter the digits.

Flashing messages on the control panel: see the Troubleshooting section in this manual.